Digital Transformation for Smart Healthcare

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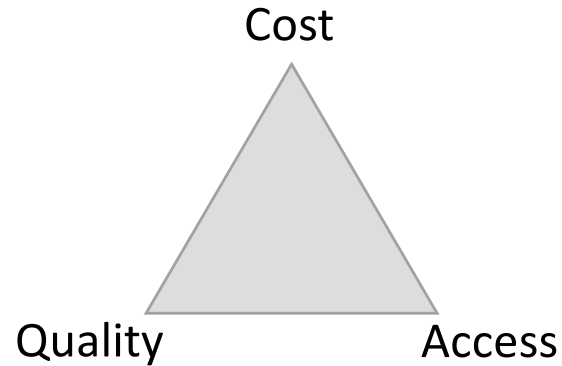
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Change is coming to healthcare...

Smart healthcare requires rethinking ...

Cost

Quality   Access

- **How we view healthcare?** Social contract or free-market solution? Personal responsibility or a human right?

- **How we deliver care?** Data driven, Personalized, Proactive, At-home

- **How we pay for healthcare?** Fee for service, Managed care, Value-based? Who bears the risk?

BUSINESS

The Million-Dollar Cancer Treatment: Who Will Pay?

So far, few patients have received the new drugs, as commercial health plans and Medicare wrestle with how to cover the treatment

Martin Fries, a 62-year-old pharmacist from Kissimee, Fla., received CAR-T cell therapy at Moffitt Cancer Center in Tampa. PHOTO: EVE EDELHEIT FOR THE WALL STREET JOURNAL
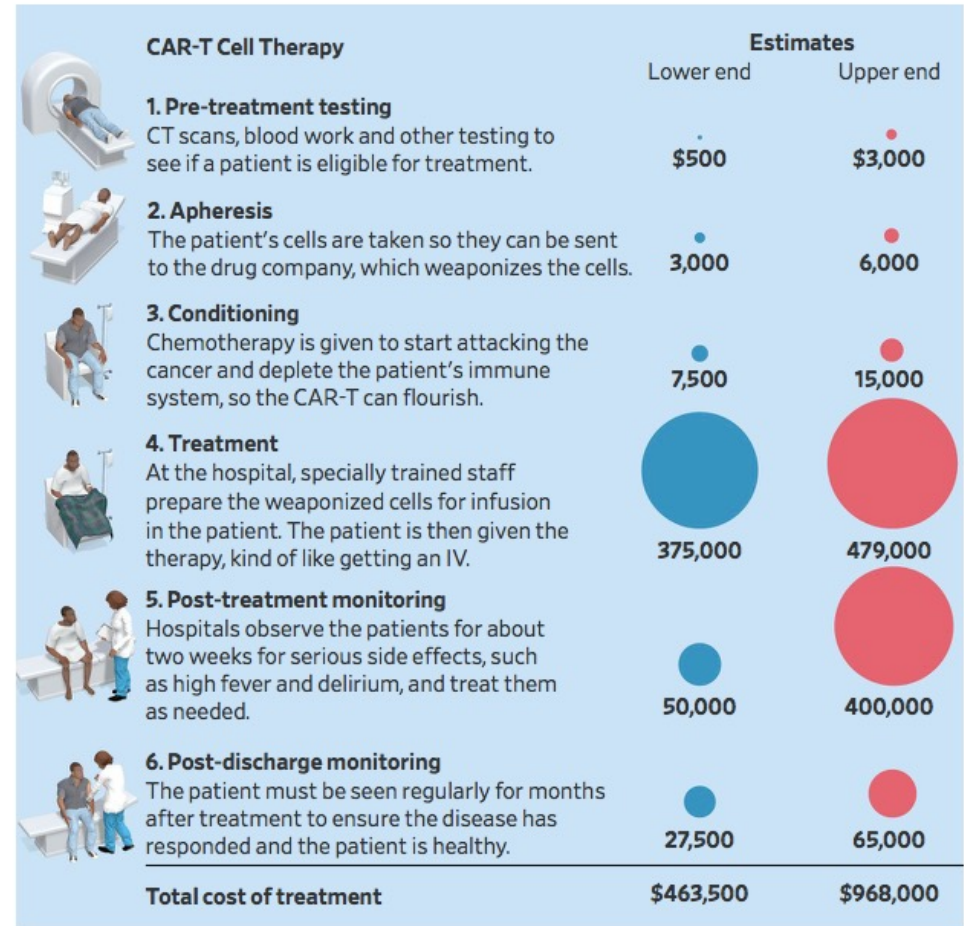
By *Jonathan D. Rockoff*

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Million-Dollar Treatment

A new wave of gene-based therapies for cancer and other diseases threatens to bring the cost of treatment to a million dollars, because both the drug and related care are expensive.

CAR-T Cell Therapy	Estimates	
	Lower end	Upper end
1. Pre-treatment testing CT scans, blood work and other testing to see if a patient is eligible for treatment.	$500	$3,000
2. Apheresis The patient's cells are taken so they can be sent to the drug company, which weaponizes the cells.	3,000	6,000
3. Conditioning Chemotherapy is given to start attacking the cancer and deplete the patient's immune system, so the CAR-T can flourish.	7,500	15,000
4. Treatment At the hospital, specially trained staff prepare the weaponized cells for infusion in the patient. The patient is then given the therapy, kind of like getting an IV.	375,000	479,000
5. Post-treatment monitoring Hospitals observe the patients for about two weeks for serious side effects, such as high fever and delirium, and treat them as needed.	50,000	400,000
6. Post-discharge monitoring The patient must be seen regularly for months after treatment to ensure the disease has responded and the patient is healthy.	27,500	65,000
Total cost of treatment	**$463,500**	**$968,000**

Source: Hospital estimates

Healthcare expenditures

- Hong Kong's total expenditure on healthcare in 2020 was US$22.7 billion or 6.2 percent of GDP
  - India 3.2%
  - USA 18%

- Per capita health expenditures in 2019
  - India $211
  - China $880
  - USA $11,945

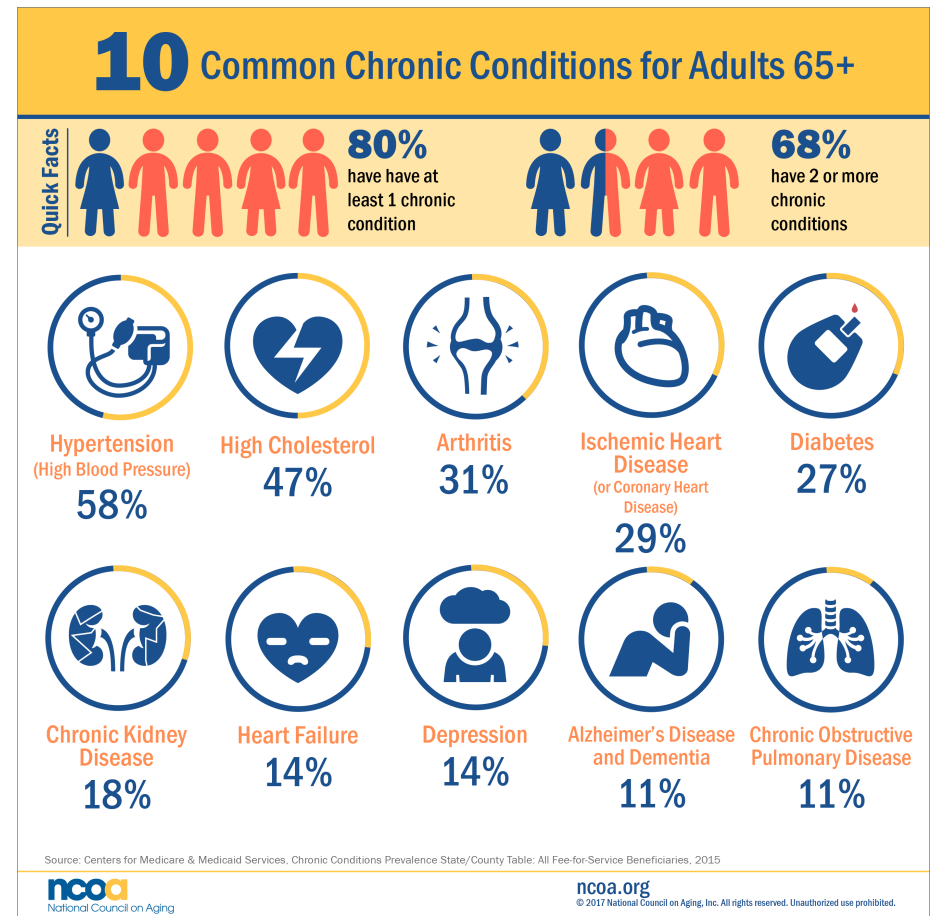https://www.trade.gov/country-commercial-guides/hong-kong-healthcare

Utilization for Chronic Disease Patients is the highest

- Chronic disease treatment consumes as much as 86% of U.S. healthcare costs

- Diabetes, the seventh leading cause of death in the U.S., affects the kidneys, blood vessels, eyes and heart

- 68% of people over the age of 65 with diabetes die from heart disease

Source: CDC.gov

10 Common Chronic Conditions for Adults 65+

Quick Facts

80% have have at least 1 chronic condition

68% have 2 or more chronic conditions

Hypertension (High Blood Pressure) 58%

High Cholesterol 47%

Arthritis 31%

Ischemic Heart Disease (or Coronary Heart Disease) 29%

Diabetes 27%

Chronic Kidney Disease 18%

Heart Failure 14%

Depression 14%

Alzheimer's Disease and Dementia 11%

Chronic Obstructive Pulmonary Disease 11%

Source: Centers for Medicare & Medicaid Services, Chronic Conditions Prevalence State/County Table: All Fee-for-Service Beneficiaries, 2015

ncoa — National Council on Aging

ncoa.org
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Chronic diseases account for 80% of deaths in China, 70% in USA

- Diabetes is among the leading chronic diseases in the population. In 2017
  - 11.2% in China (1% in 1980)
  - 11.2% in India (in urban areas)
  - 10.5% in USA
- One in three of world's adults with diabetes is in China (WHO, 2016)
- Two-thirds of diabetes cases were undiagnosed
- Only 25.8% of diabetics were receiving treatment
- Over half of Chinese adults were prediabetic

Sources:
https://www.healthline.com/health/diabetes/diabetes-in-india#by-the-numbers
http://www.cdc.gov/nccdphp/overview.htm
https://www.scmp.com/lifestyle/health-beauty/article/1934513/one-three-worlds-adults-diabetes-china-who-reports
https://en.wikipedia.org/wiki/Chronic_disease_in_China#Economic_consequences
https://www.medscape.com/viewarticle/810357
Journal of the American Medical Association (2013)

How to Deal with Rising Healthcare Costs?
Baumol's "Cost Disease" vs. Koop et al.'s Utilization Reduction
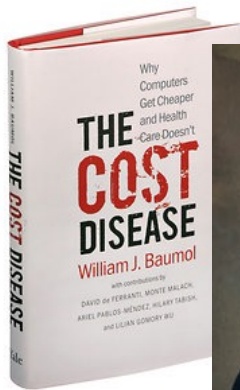
William J. Baumol

Healthcare costs as a percent of GDP will continue to rise. This is a sign of an affluent society.

C. Edward Koop; The Health Project

Healthcare costs can be controlled by reducing the need and demand for medical services [utilization].

Digital Transformation
First Principles

1. Minimize or eliminate friction in an exchange – enabled by digital technologies

2. Digital technologies are Social, Mobile, Analytics, Collaborative and Internet of Things (SMACIT)

3. Reimagine activities in an exchange

   a. Social exchange – Facetime with Mom

   b. Business exchange – telehealth visit with physician

   c. Knowledge exchange -- Patientslikeme.com

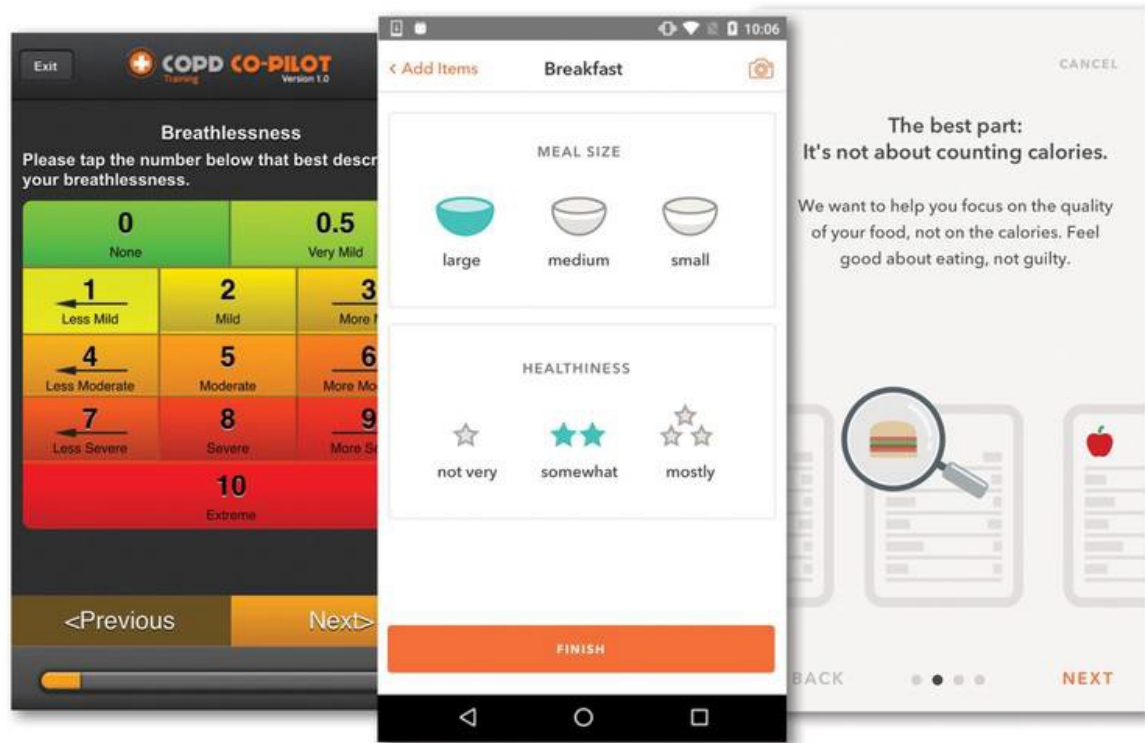4. Weave activities into a digitally-enabled process that creates value

Healthcare Digital Transformation removes friction in

- Patient engagement

- Coordination of patient care

- Dissemination of learning from population health to individual healthcare

Patient engagement in chronic disease management

Coordination of Care issues in Healthcare

- **Policy issues** -- Focus on Wellness, Chronic diseases, Racial disparities

- **Cultural issues** -- Privacy, Mental health, End-of-Life planning

- **Scientific issues** -- Gene editing, CRISPR, Neurologic

- **Political issues** -- Medicare for All, how to fund healthcare, Women's health

- **Market issues** -- Democratization of healthcare with cheaper, easy, personalized, and close to home care

- **Technology issues** -- Artificial Intelligence and Machine Learning – how to de-bias
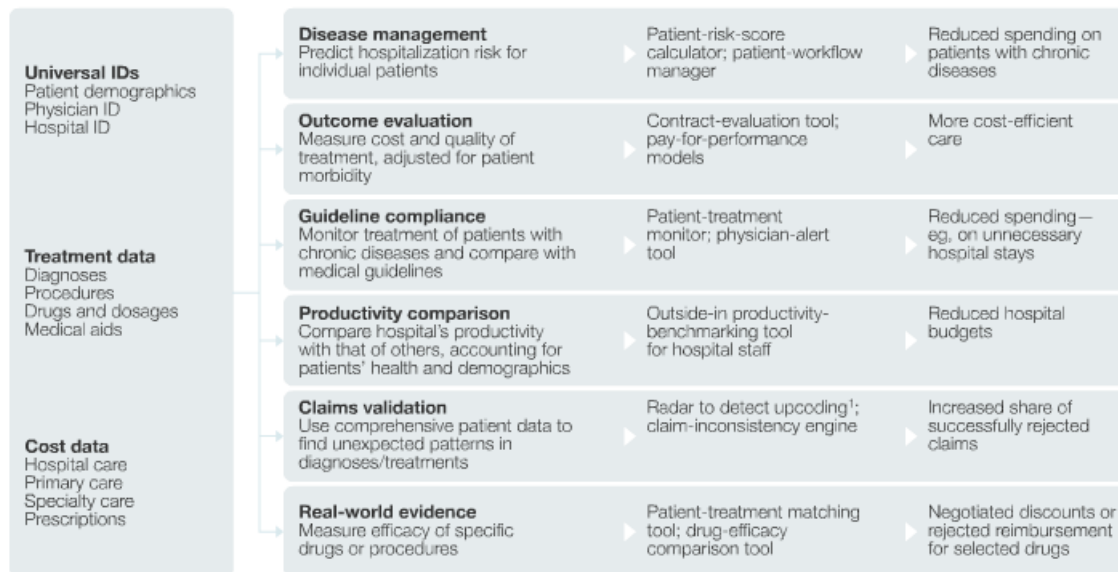
Dissemination of Learning in Healthcare

A successful data plan will focus on three core elements.

Health-care industry, public-payer illustration

Interlinked data inputs +	Analytic models +	Decision-support tools =	Business value
Universal IDs Patient demographics Physician ID Hospital ID	**Disease management** Predict hospitalization risk for individual patients	Patient-risk-score calculator; patient-workflow manager	Reduced spending on patients with chronic diseases
	Outcome evaluation Measure cost and quality of treatment, adjusted for patient morbidity	Contract-evaluation tool; pay-for-performance models	More cost-efficient care
Treatment data Diagnoses Procedures Drugs and dosages Medical aids	**Guideline compliance** Monitor treatment of patients with chronic diseases and compare with medical guidelines	Patient-treatment monitor; physician-alert tool	Reduced spending— eg, on unnecessary hospital stays
	Productivity comparison Compare hospital's productivity with that of others, accounting for patients' health and demographics	Outside-in productivity-benchmarking tool for hospital staff	Reduced hospital budgets
Cost data Hospital care Primary care Specialty care Prescriptions	**Claims validation** Use comprehensive patient data to find unexpected patterns in diagnoses/treatments	Radar to detect upcoding[1]; claim-inconsistency engine	Increased share of successfully rejected claims
	Real-world evidence Measure efficacy of specific drugs or procedures	Patient-treatment matching tool; drug-efficacy comparison tool	Negotiated discounts or rejected reimbursement for selected drugs

Innovative business models in Healthcare

- OpenTable as model for iTriage

- Patientslikeme.com (Facebook groups)

- Cellscope's Oto iPhone takes images of ear canal (mTailor)

- Nomad for locum physicians (Uber)

- Amazon's Alexa uses AI to schedule urgent care appointments, track drugs shipped, check health insurance benefits and reads blood sugar results

Source: PwC Health Research Institute | Healthcare's new entrants: Who will be the industry's Amazon.com

Temporal Displacement of Care

Care patterns of diabetes chronic disease

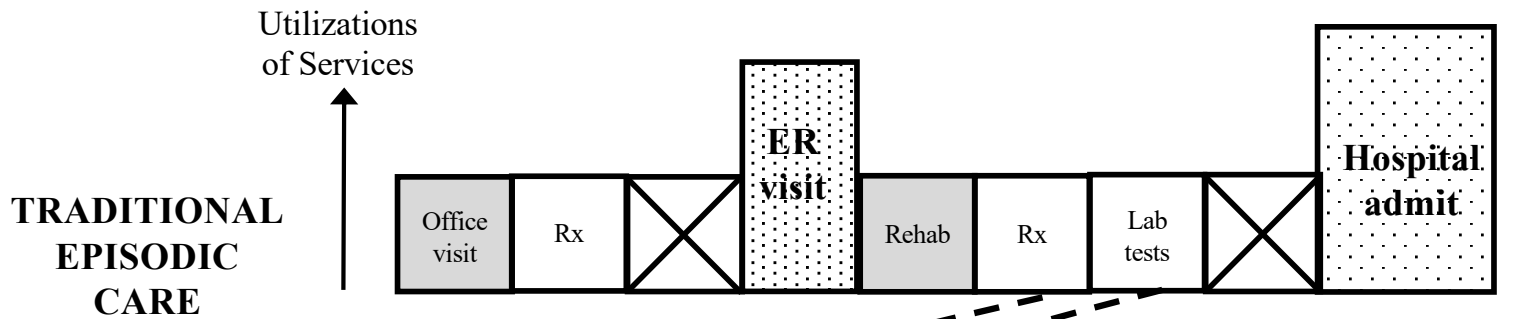| Intervention level	Low	Medium	High
Treatment venue	Physician office and outpatient visit	Emergency room visit	Inpatient hospital admission
Description	Low-cost interventions are treatments that can be performed in the **physician office or outpatient treatment center**	Medium cost interventions include treatments that require **constant medical supervision** but do not require hospitalization	High-cost interventions include treatments related to advanced disease and typically **require hospitalization**
Examples	Routine screening, nutrition and lifestyle counseling, laboratory testing, and eye and neuropathy exams	Intravenous insulin and anti-hypertensive therapy	Coronary artery bypass grafts, angioplasty, coronary artery stent, limb amputation, kidney dialysis, and organ transplant

Theory of Temporal Displacement of Care (TDC)

- TDC proposes that healthcare organizations can create value for providers of chronic disease care by using IT and analytics to *displace the time at which clinicians and patients make interventions*

- Theory base: Temporality in Operations literature

  o Total Quality Management (Deming, 1986; Hackman and Wageman 1995)

  o Delayed differentiation created through standardization, using common components in multiple products, and modularization (Lee and Tang 1997), Example: a "vanilla" computer, to which components are added per demand

Utilizations of Services

TRADITIONAL EPISODIC CARE

| Office visit | Rx | ✕ | ER visit | Rehab | Rx | Lab tests | ✕ | Hospital admit |

Displacement of Care

TEMPORAL DISPLACEMENT OF CARE

| Office visit | Rx | Lab tests | Rx | Office visit | Rx | Lab tests | Rx | Office visit |

Temporal Dimension
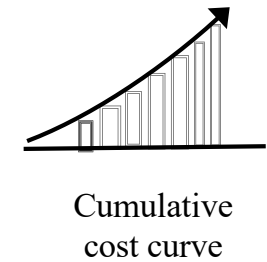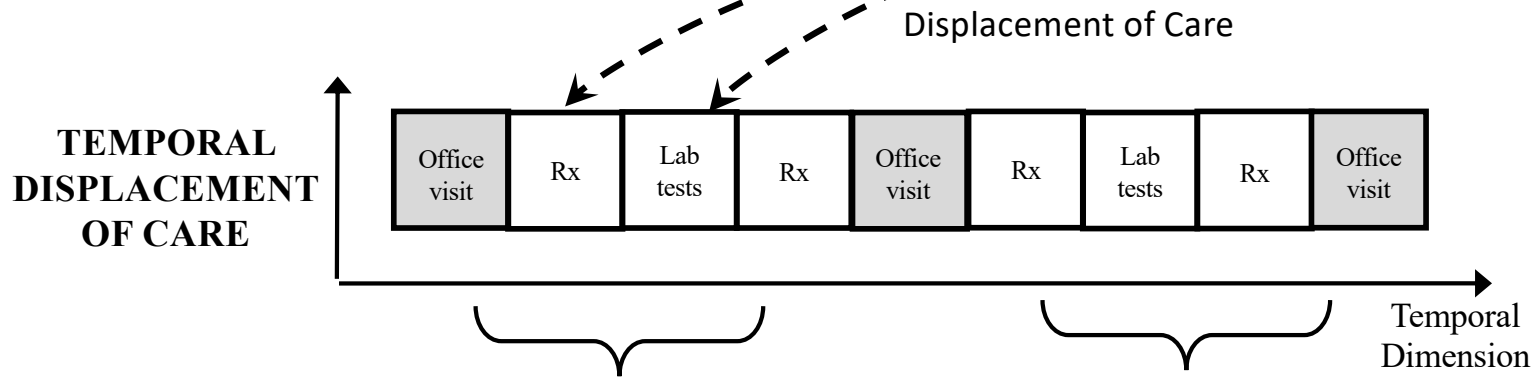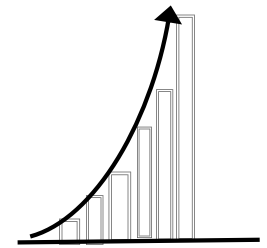
Information technology identifies which activities to displace

Analytics monitors and manages health status and interventions

Cumulative cost curve

# A-B-C Cube to prioritize chronic conditions
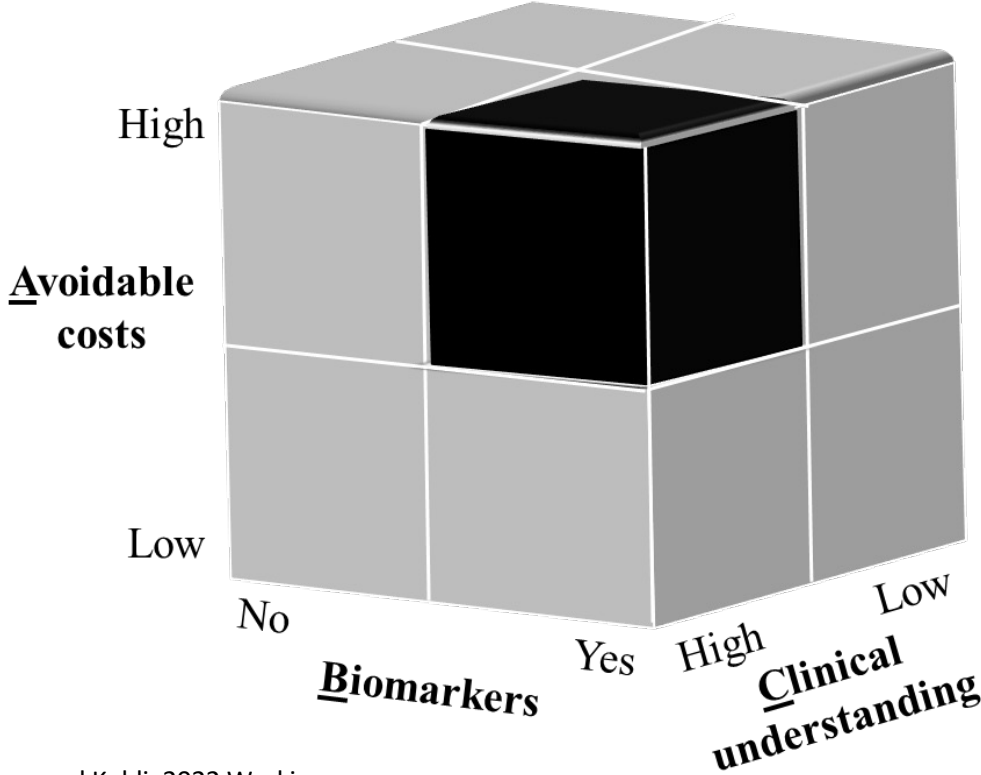
Smart Healthcare needs cross-disciplinary research

- <u>Service</u> Excellence – Consumer behavior, Trust

- Digital <u>infrastructure</u> – data standards, cybersecurity, systems integration

- <u>Personalized</u> medicine and tele-health – design science

- <u>Change</u> and Process Management

- <u>Cost</u> management – Activity Based Costing, Pay for performance

- <u>Pricing</u> of pharmaceutical and medical devices

- Understanding business <u>risk</u> – Actuarial science

- Predictive <u>analytics</u> – intervening for patients "at-risk"

Further reading
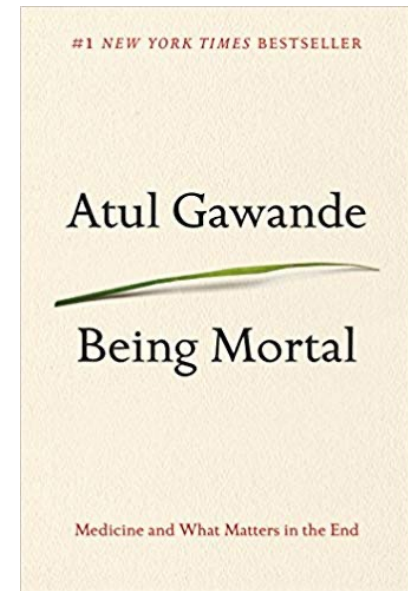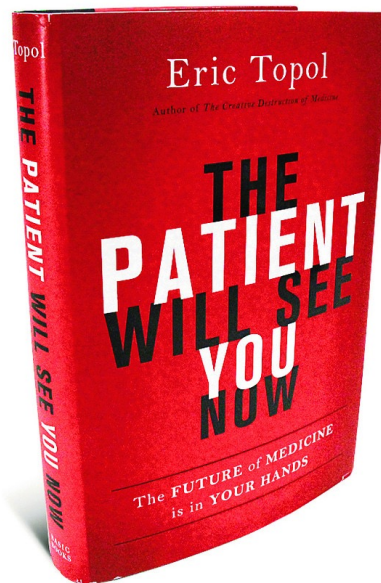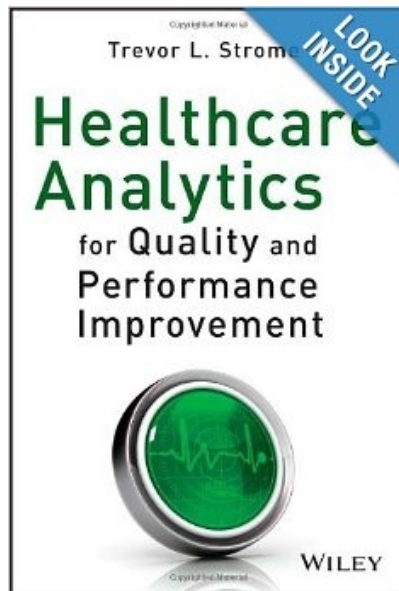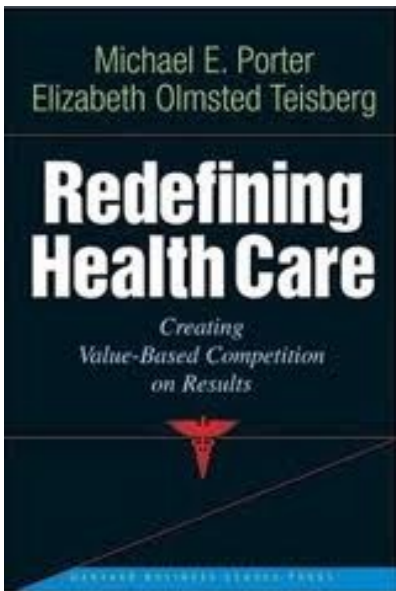
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Average annual per-capita cost for ACRG3*
of all Chronic Diseases

ACRG3 STATUS	2009	2010	2011	2012	2013	2014
1	$834.32	$860.93	$888.95	$915.98	$969.79	$997.08
2	$3,227.71	$3,213.99	$3,235.93	$3,394.78	$3,495.04	$3,631.87
3	$3,766.08	$3,925.37	$3,917.06	$4,026.37	$4,144.92	$4,288.33
4	$6,776.59	$7,111.12	$7,244.89	$7,384.58	$7,540.80	$7,663.98
5	$6,679.76	$6,882.97	$7,125.80	$7,381.59	$7,760.06	$8,033.34
6	$15,522.84	$16,166.60	$16,758.83	$17,463.24	$18,271.48	$19,298.84
7	$48,940.41	$47,046.86	$49,227.56	$54,672.28	$47,022.83	$49,067.53
8	$58,852.36	$60,867.94	$64,444.16	$67,714.11	$73,378.25	$80,457.09
9	$34,519.20	$42,512.87	$44,988.06	$44,401.08	$46,767.64	$45,364.26

*Aggregated Clinical Risk Groups (ACRG3) Scores

Distribution of ACRG3 in Chronic Diseases
Examine aggregated or each Chronic Disease separately?

ACRG3										Acronym	Condition	
ACRG3	CHD	CHF	COPD	DEP	DM	HTN	CA		CHANGE	CHD	Coronary heart disease	
1	0%	0%	0%	0%	0%	0%	0%	0%		CHF	Congestive heart failure	
2	0%	0%	0%	0%	0%	0%	0%	0%	0%	COPD	Chronic obstructive pulmonary dise	
3	30%	0%	0%	10%	14%	20%	3%	77%	77%	DEP	Depression	
4	55%	3%	1%	13%	29%	35%	8%	144%	67%	DM	Diabetes mellitus	
5	63%	4%	3%	16%	35%	38%	14%	173%	29%	HTN	Hypertension	
6	66%	12%	7%	22%	47%	42%	28%	224%	51%	CA	Cancer	
7	65%	26%	7%	29%	52%	46%	33%	258%	34%			
8	74%	29%	9%	33%	58%	53%	43%	299%	41%			
9	65%	32%	10%	45%	62%	50%	37%	301%	2%			
AVERAGE	46%	12%	4%	19%	33%	32%	18%					

Percentages are greater than 100 because
patients can have multiple chronic diseases